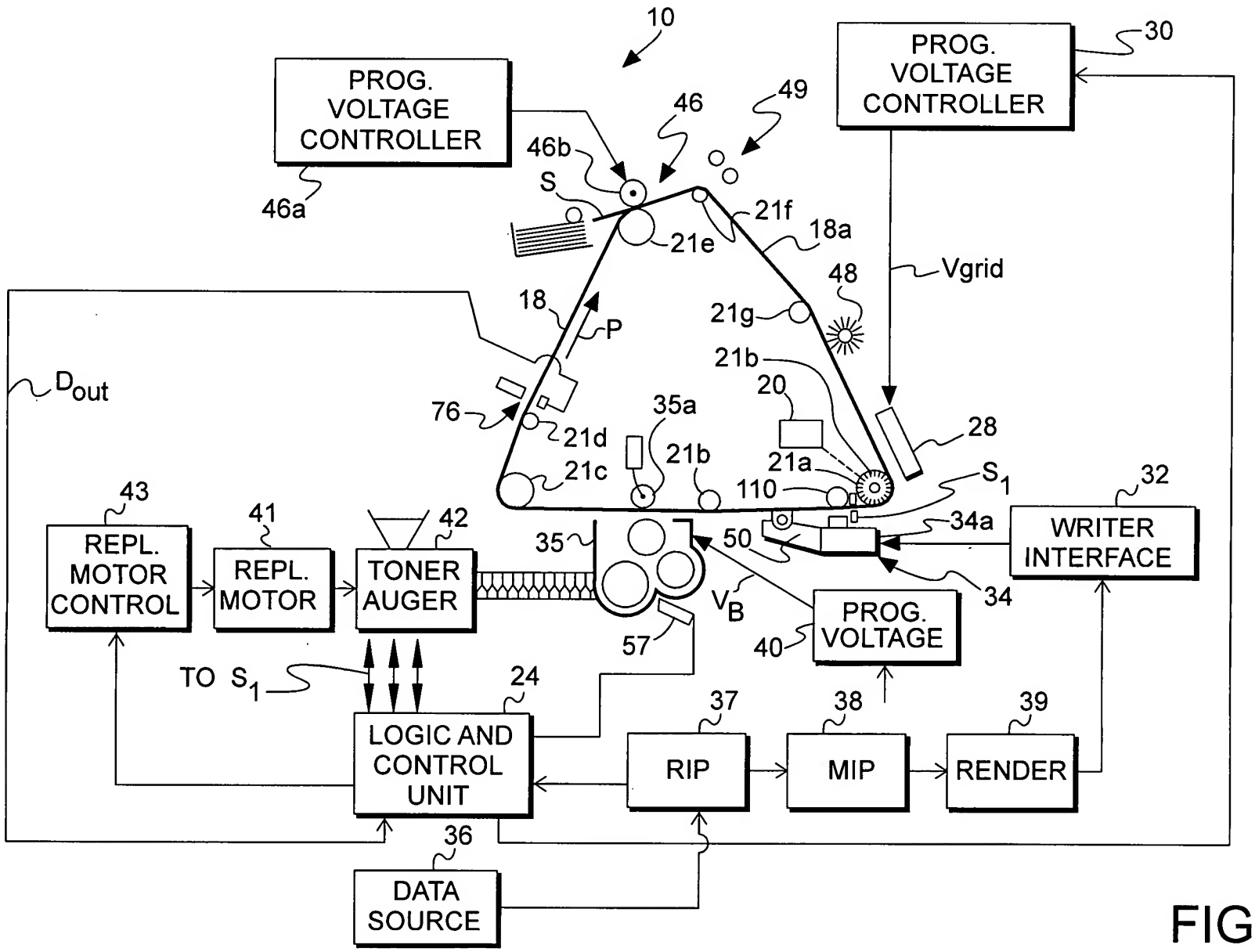

10
PROG. VOLTAGE CONTROLLER
46a
46b
S
46
49
PROG. VOLTAGE CONTROLLER
30
21f
18a
21e
Vgrid
48
18
P
21g
21b
20
D_{out}
76
21d
35a
21b
21c
21a
28
110
S_1
32
43
41
42
35
50
34a
WRITER INTERFACE
REPL. MOTOR CONTROL
REPL. MOTOR
TONER AUGER
V_B
34
PROG. VOLTAGE
40
57
TO S_1
24
37
38
39
LOGIC AND CONTROL UNIT
RIP
MIP
RENDER
36
DATA SOURCE

FIG. 1a

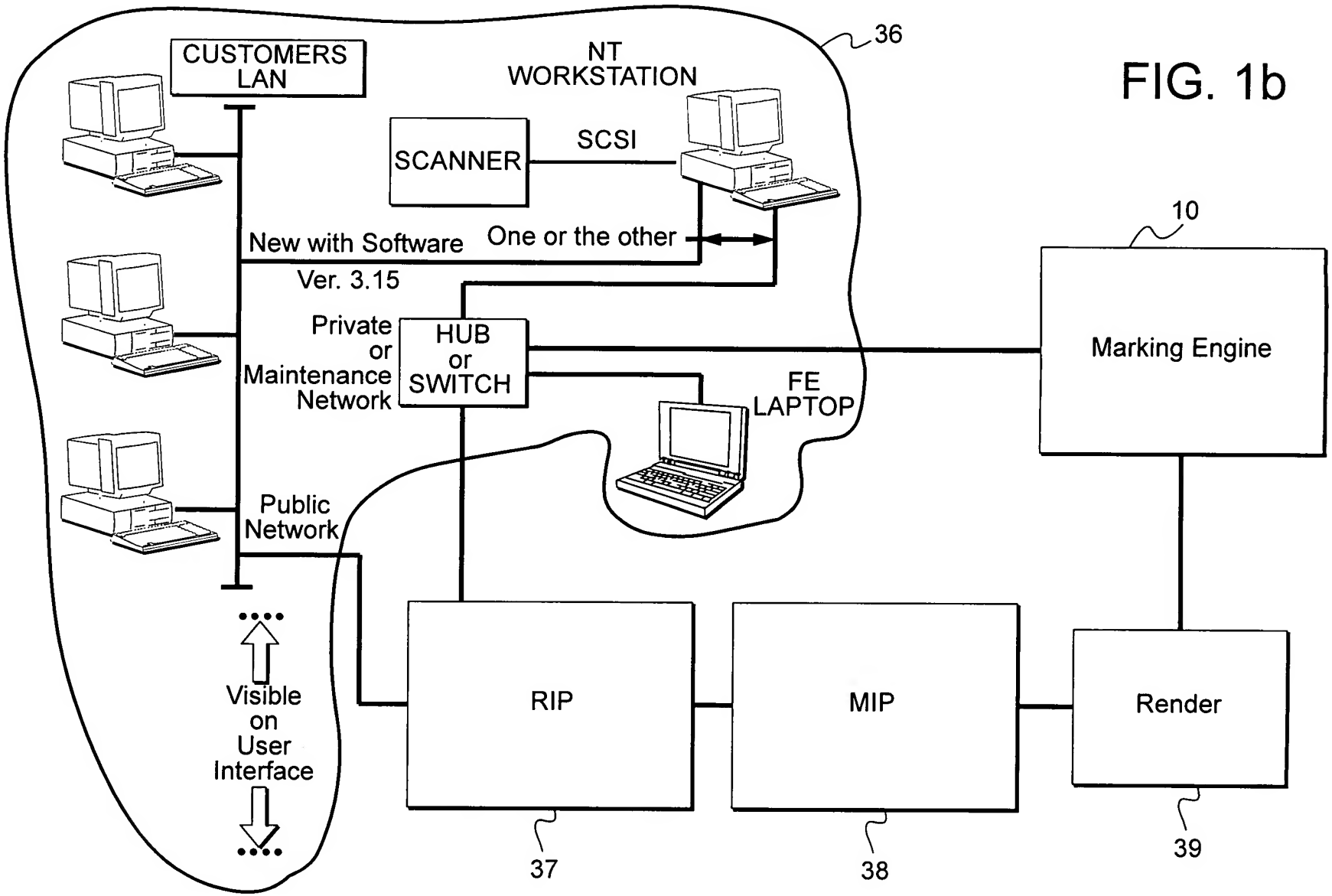

36
CUSTOMERS LAN
NT WORKSTATION
SCANNER
SCSI
New with Software Ver. 3.15
One or the other
Private or Maintenance Network
HUB or SWITCH
FE LAPTOP
10
Marking Engine
Public Network
Visible on User Interface
RIP
MIP
Render
37
38
39

FIG. 1b

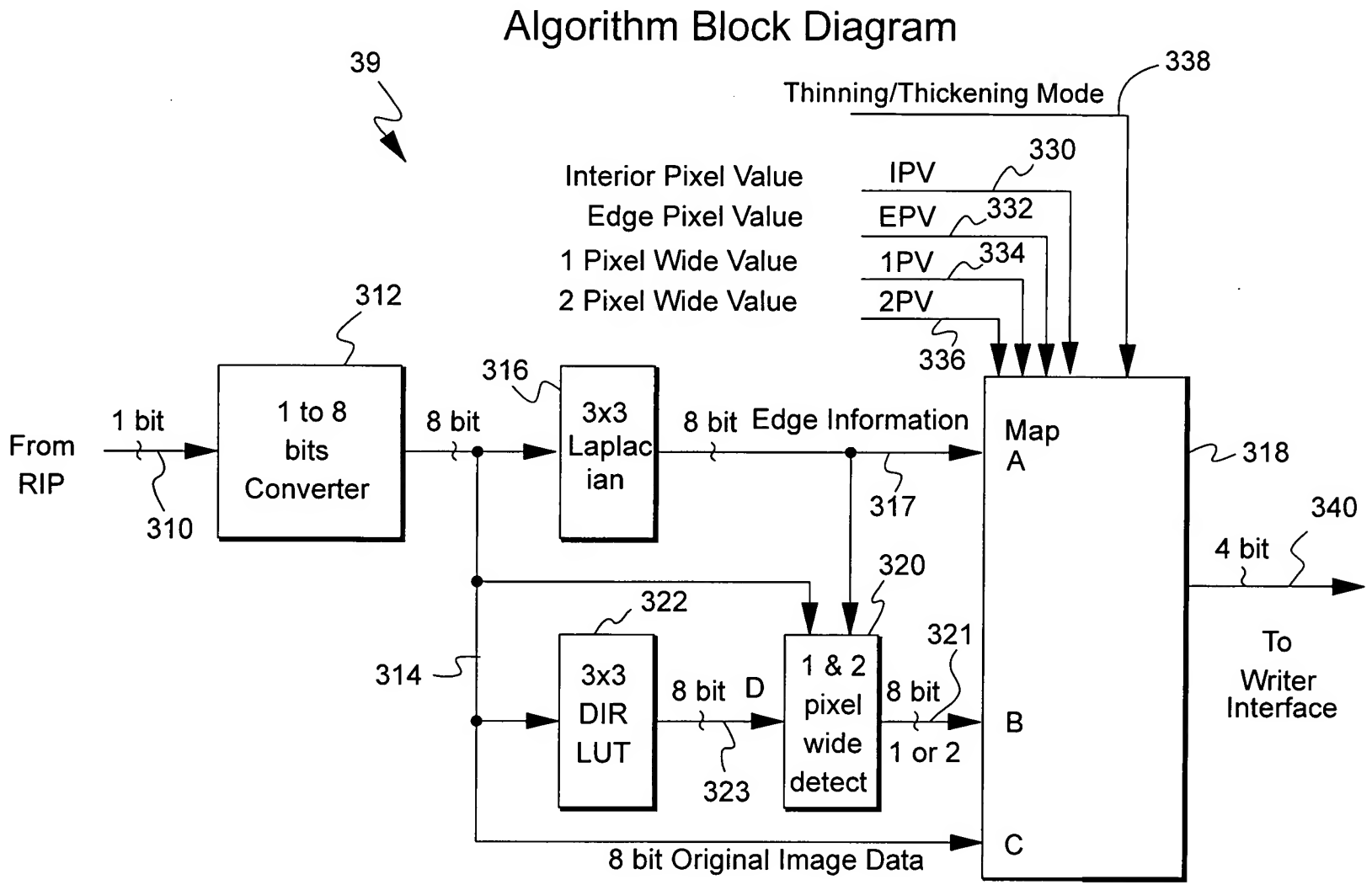

Algorithm Block Diagram
39
Thinning/Thickening Mode
338
Interior Pixel Value
IPV
330
Edge Pixel Value
EPV
332
1 Pixel Wide Value
1PV
334
2 Pixel Wide Value
2PV
336
312
316
From RIP
1 bit
310
1 to 8 bits Converter
8 bit
3x3 Laplac ian
8 bit Edge Information
317
Map A
318
340
4 bit
To Writer Interface
320
322
314
3x3 DIR LUT
8 bit D
323
1 & 2 pixel wide detect
8 bit
1 or 2
321
B
C
8 bit Original Image Data

FIG. 2

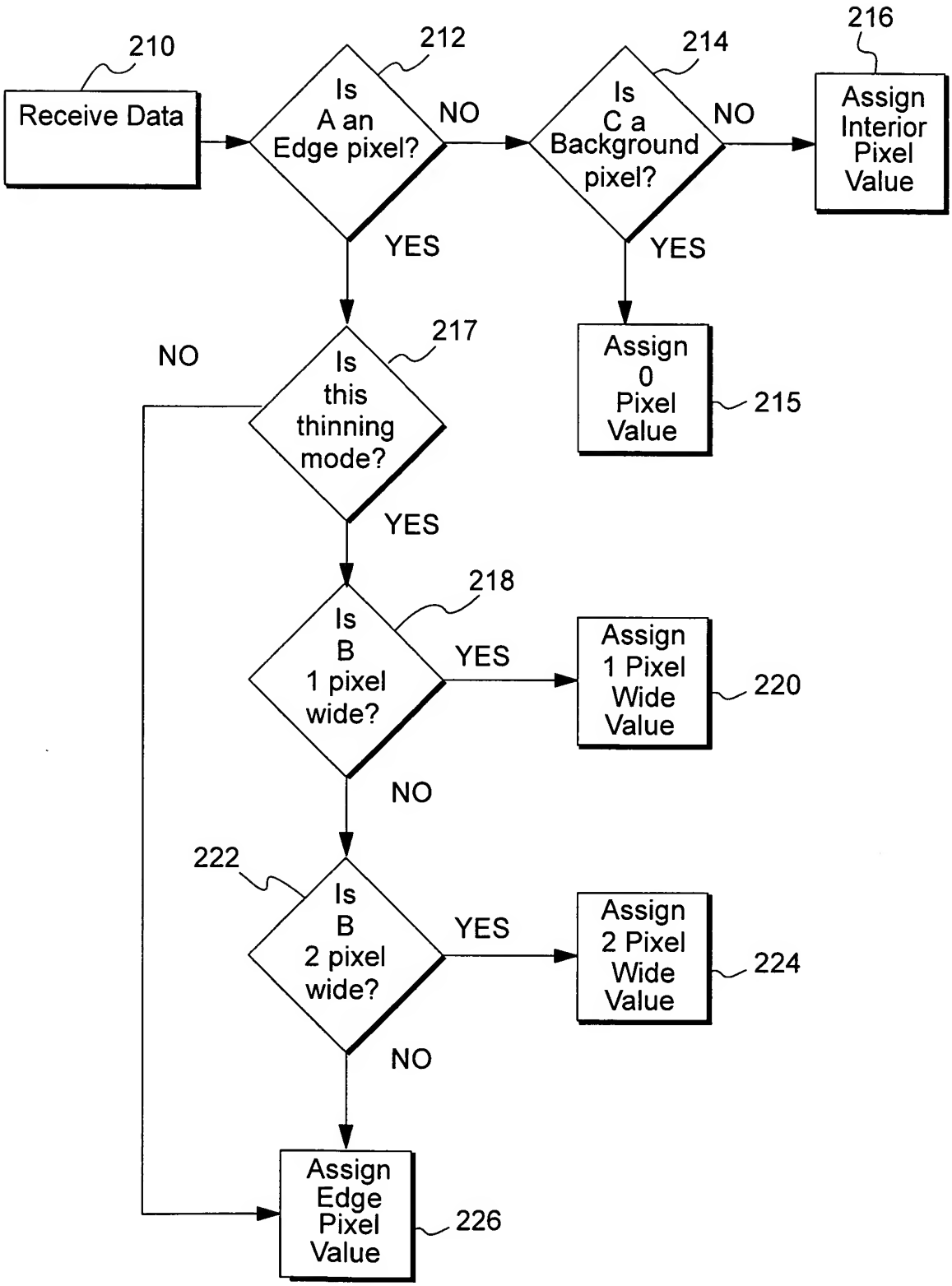

210
Receive Data
212
Is A an Edge pixel?
NO
214
Is C a Background pixel?
NO
216
Assign Interior Pixel Value
YES
YES
217
Is this thinning mode?
NO
Assign 0 Pixel Value
215
YES
218
Is B 1 pixel wide?
YES
Assign 1 Pixel Wide Value
220
NO
222
Is B 2 pixel wide?
YES
Assign 2 Pixel Wide Value
224
NO
Assign Edge Pixel Value
226

FIG. 3

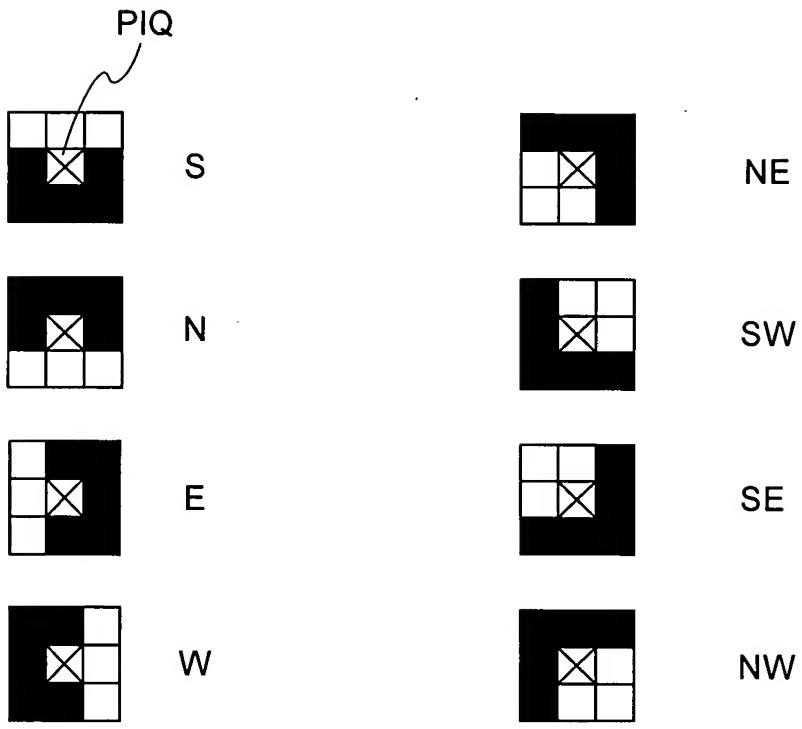


FIG. 4

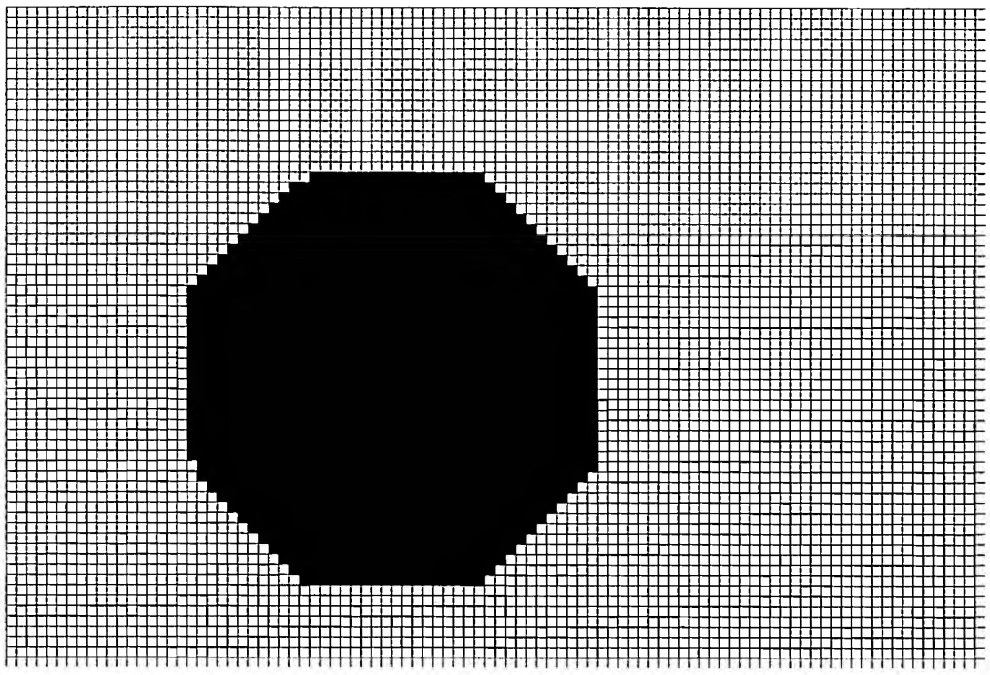


Fig. 5a
Original object bitmap

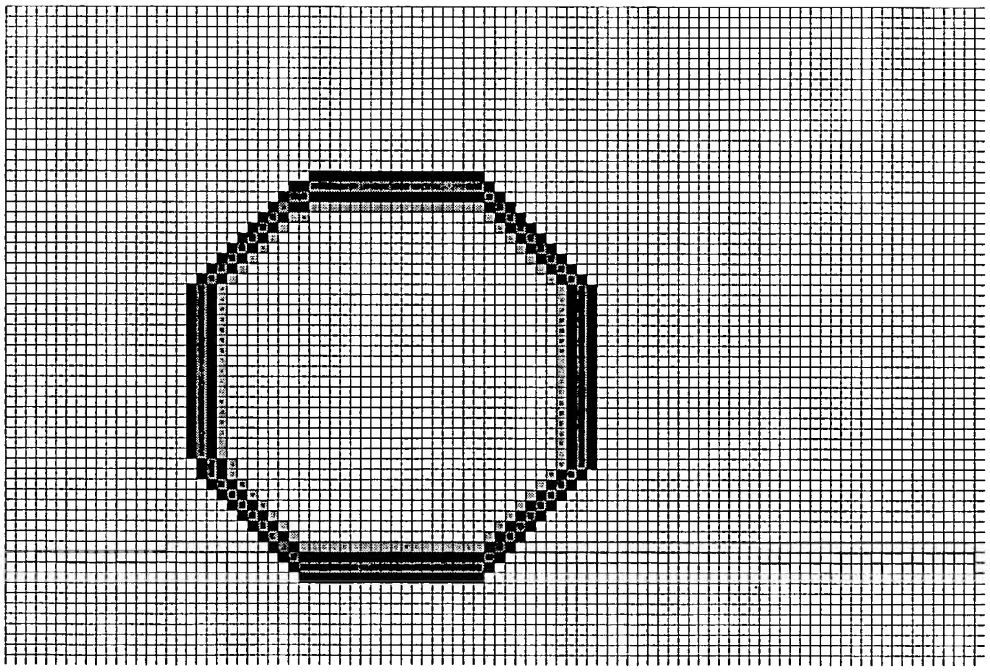


Fig. 5b
Four onion skin layers
when thinning

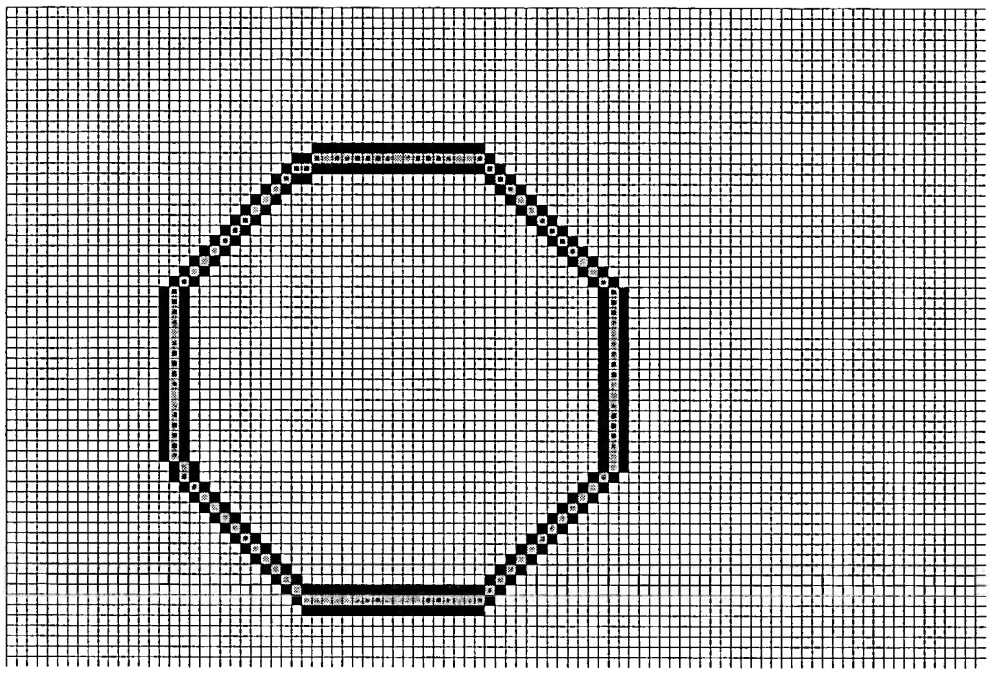


Figure 5c
Three onion skin layers
when thickening

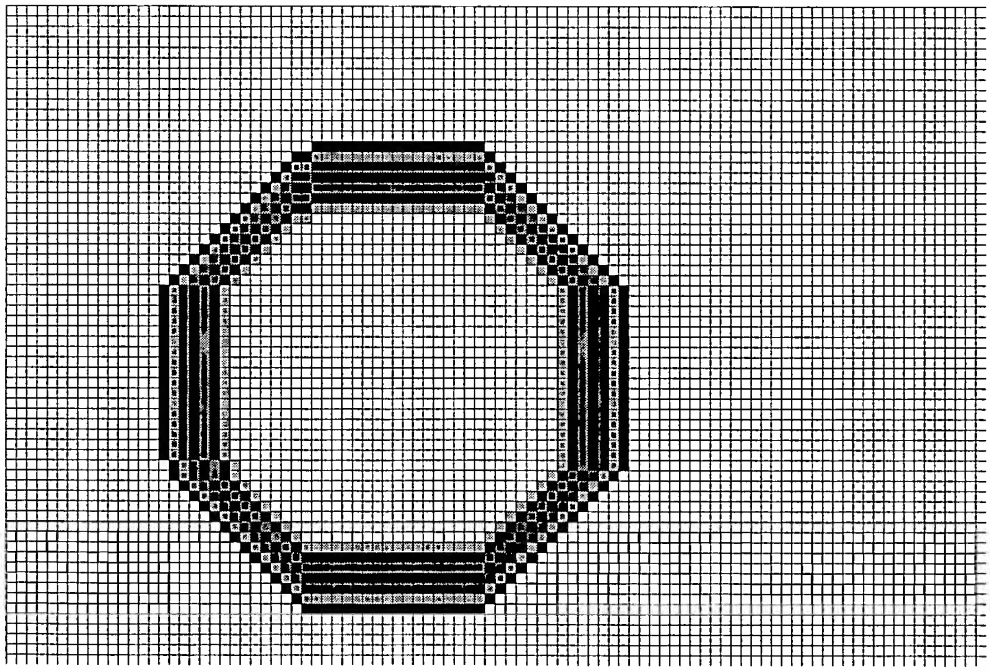


Fig. 5d
All layers
(thickening and thinning)

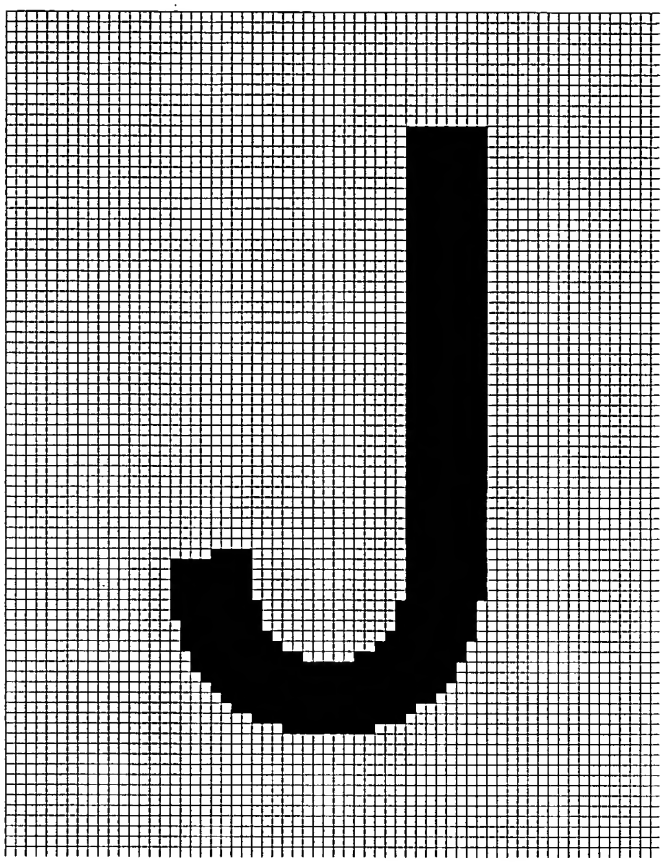


Fig. 6a
Original

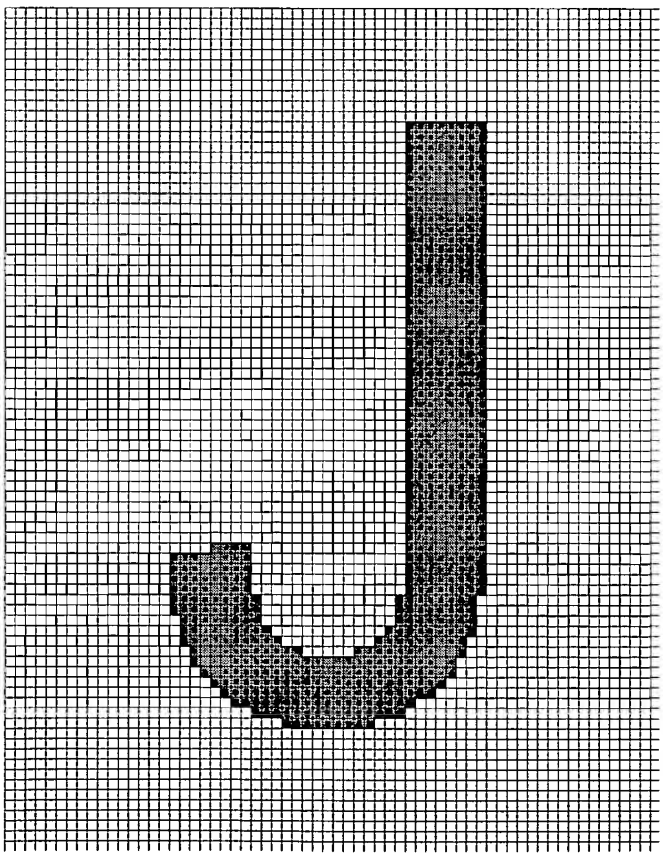


Fig. 6b
Same grey pixel value assigned to edges and solid area density

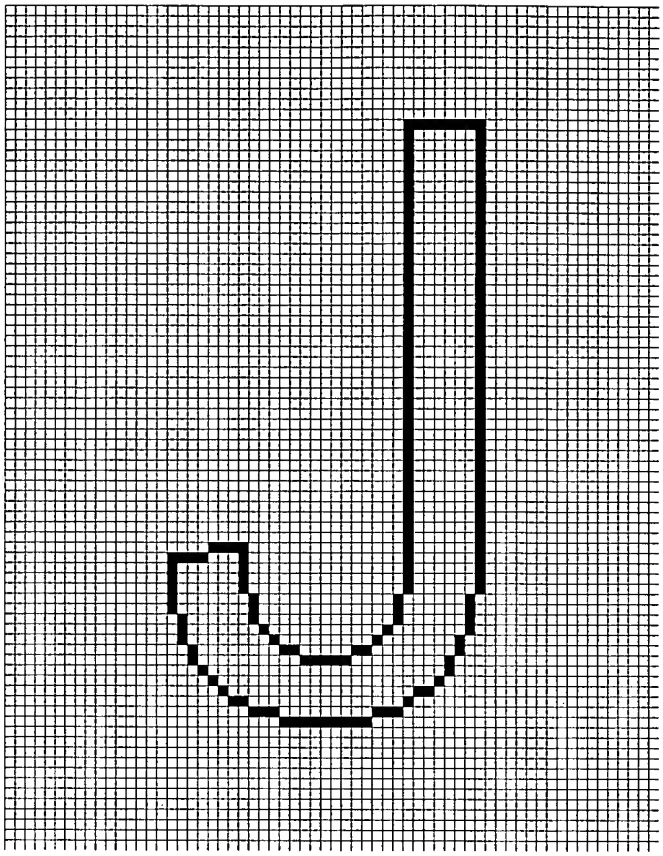


Fig. 6c
Edges when thinning

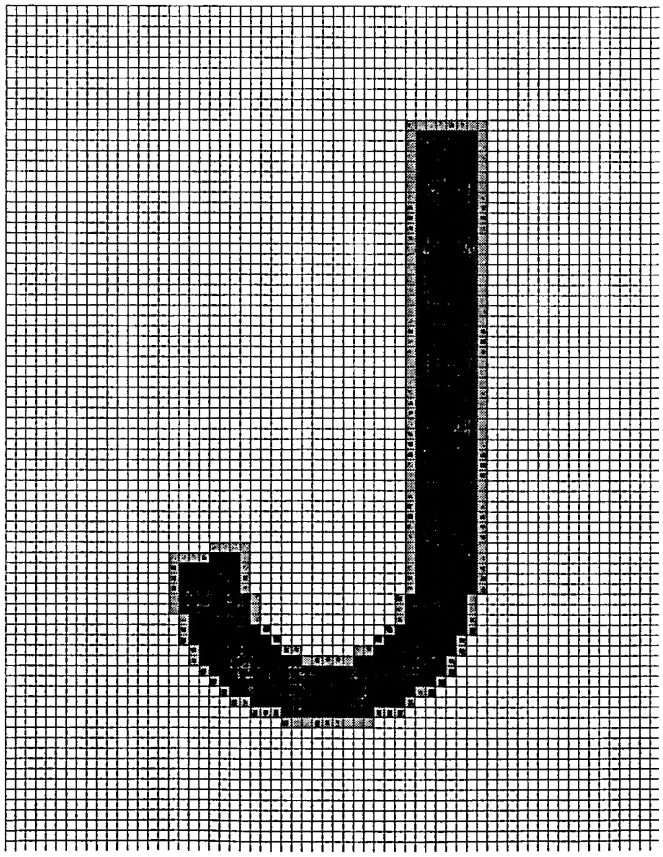


Fig. 6d
Lightened -
Solid area density reduced
Letter thinner

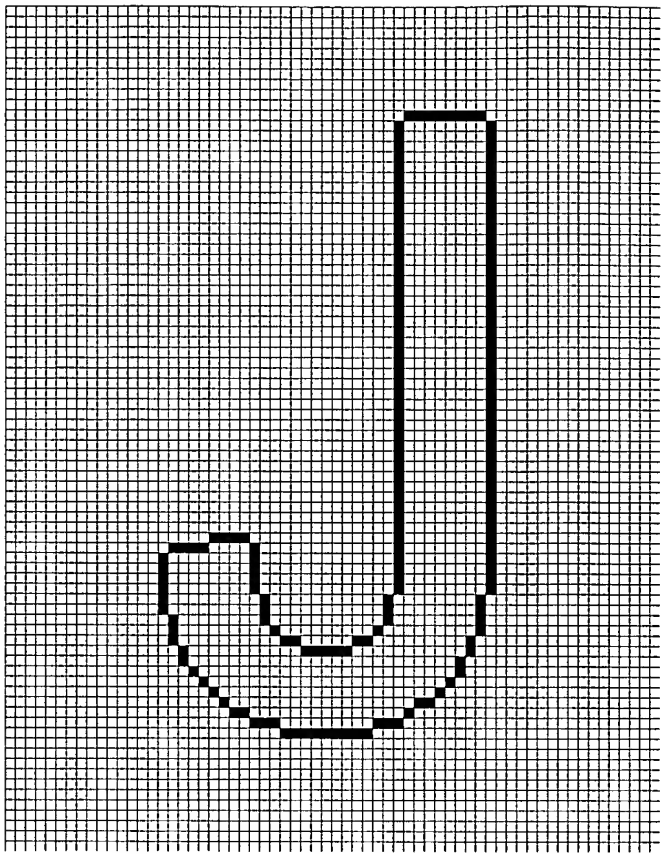


Fig. 6e
Edges when thickening

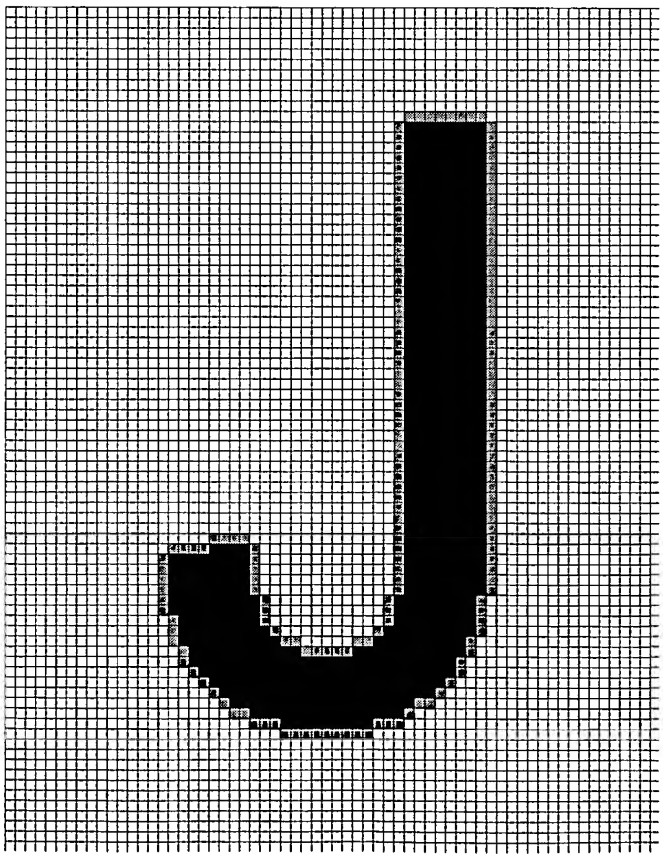
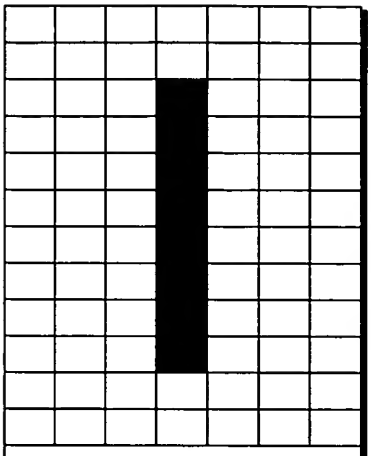


Fig. 6f
Thickened
Letter thickened by applying grey edges which were originally white

1 Pixel Wide Detection



Original 1 pixel wide line

FIG. 7a

0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Edge Pixels

FIG. 7b

0	0	0	0	0	0	0
0	0	SE	S	SW	0	0
0	0	E	S	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	N	W	0	0
0	0	NE	N	NW	0	0
0	0	0	0	0	0	0

Direction Values

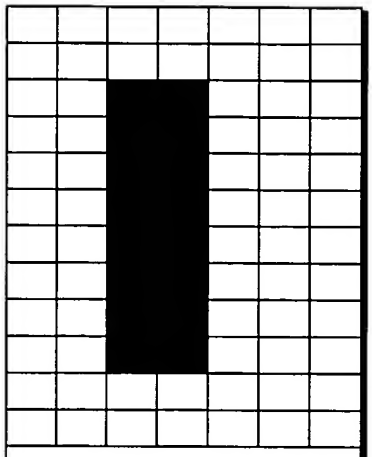
FIG. 7c

BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	EP	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	EP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP

Assignment
BP: Background Pixel
EP: Edge Pixel
1W: One Pixel Wide Line

FIG. 7d

2 Pixel Wide Detection



Original 2 pixel wide line

FIG. 8a

0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Edge Pixels

FIG. 8b

0	0	0	0	0	0	0
0	SE	S	S	SW	0	0
0	E	SE	SW	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	NE	NW	W	0	0
0	NE	N	N	NW	0	0
0	0	0	0	0	0	0

Direction Values

FIG. 8c

BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	EP	EP	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	EP	EP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP

Assignment
BP: Background Pixel
EP: Edge Pixel
2W: Two Pixel Wide Line

FIG. 8d

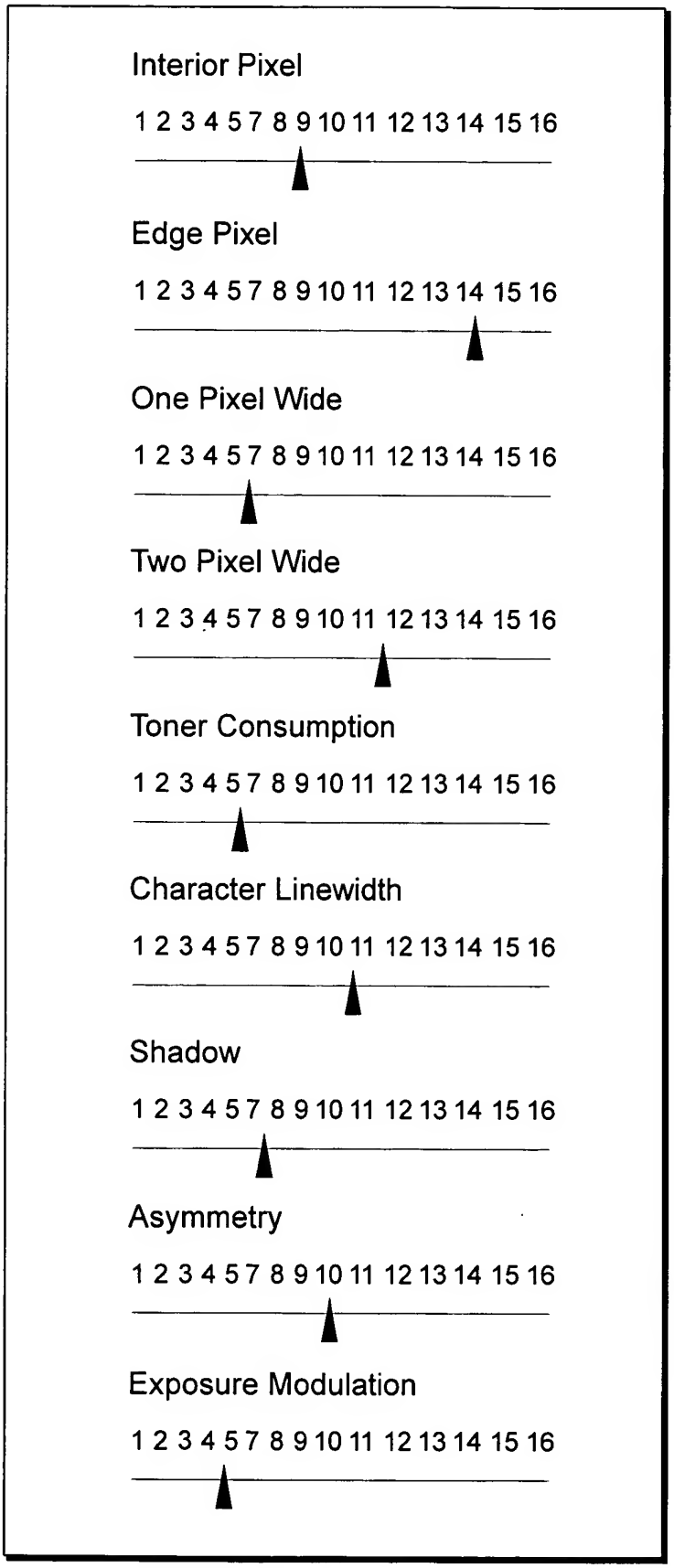

Interior Pixel
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Edge Pixel
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
One Pixel Wide
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Two Pixel Wide
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Toner Consumption
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Character Linewidth
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Shadow
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Asymmetry
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Exposure Modulation
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

FIG. 9

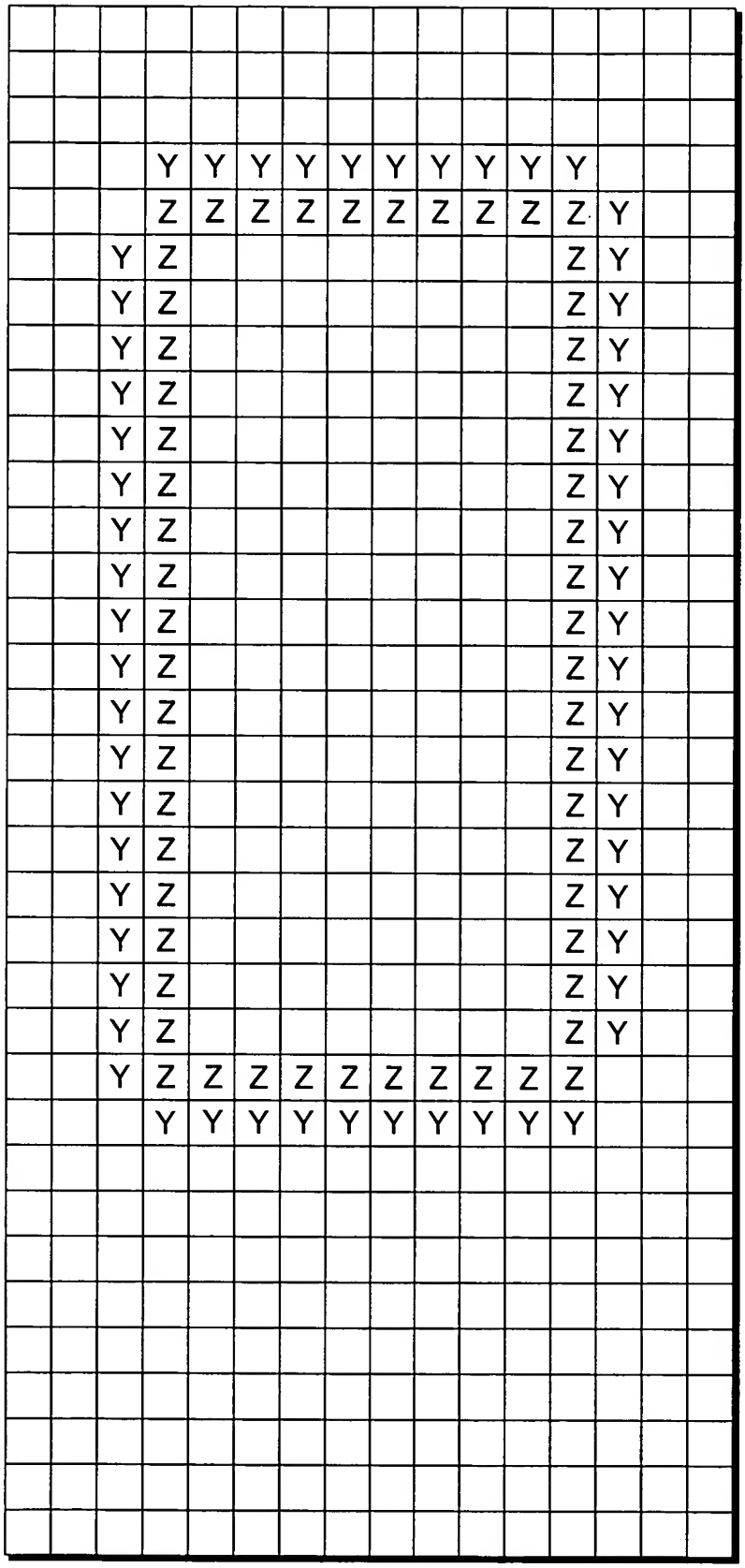

Y Y Y Y Y Y Y Y Y Y Y
Z Z Z Z Z Z Z Z Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Z Z Z Z Z Z Z Z
Y Y Y Y Y Y Y Y Y Y

FIG. 10

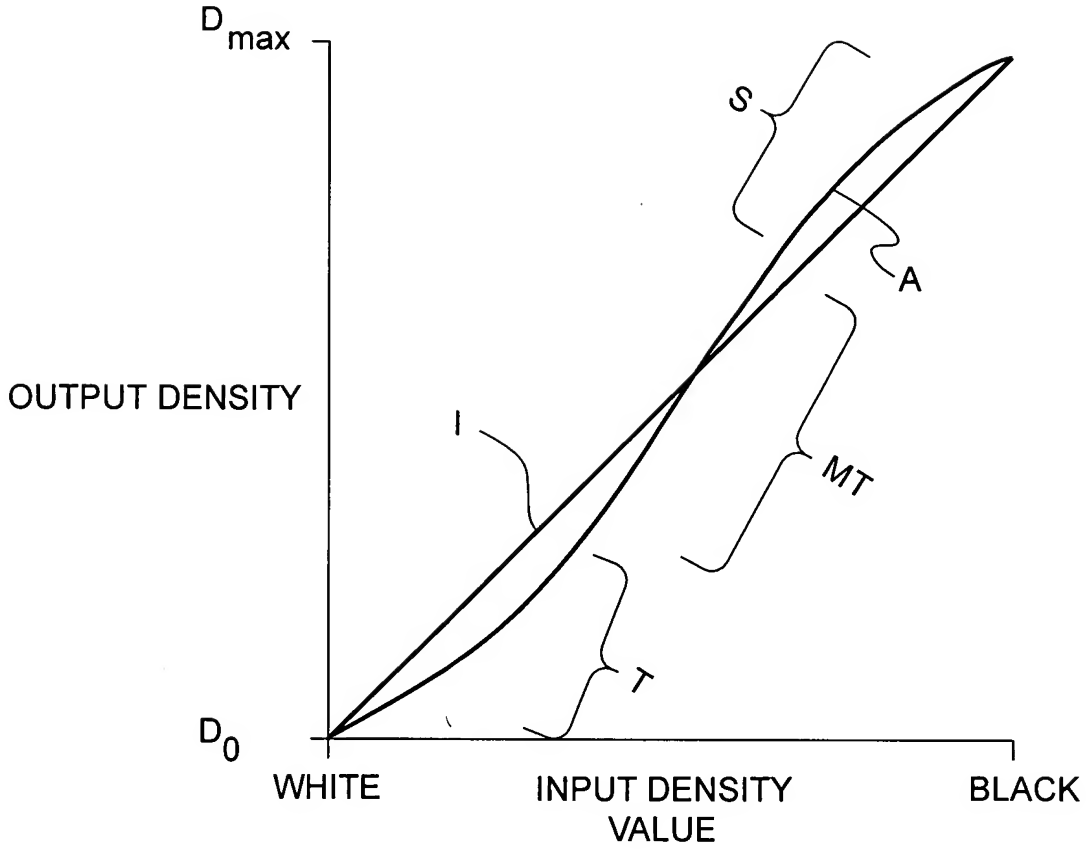

D max
S
A
OUTPUT DENSITY
I
MT
T
D0
WHITE
INPUT DENSITY VALUE
BLACK

FIG. 11

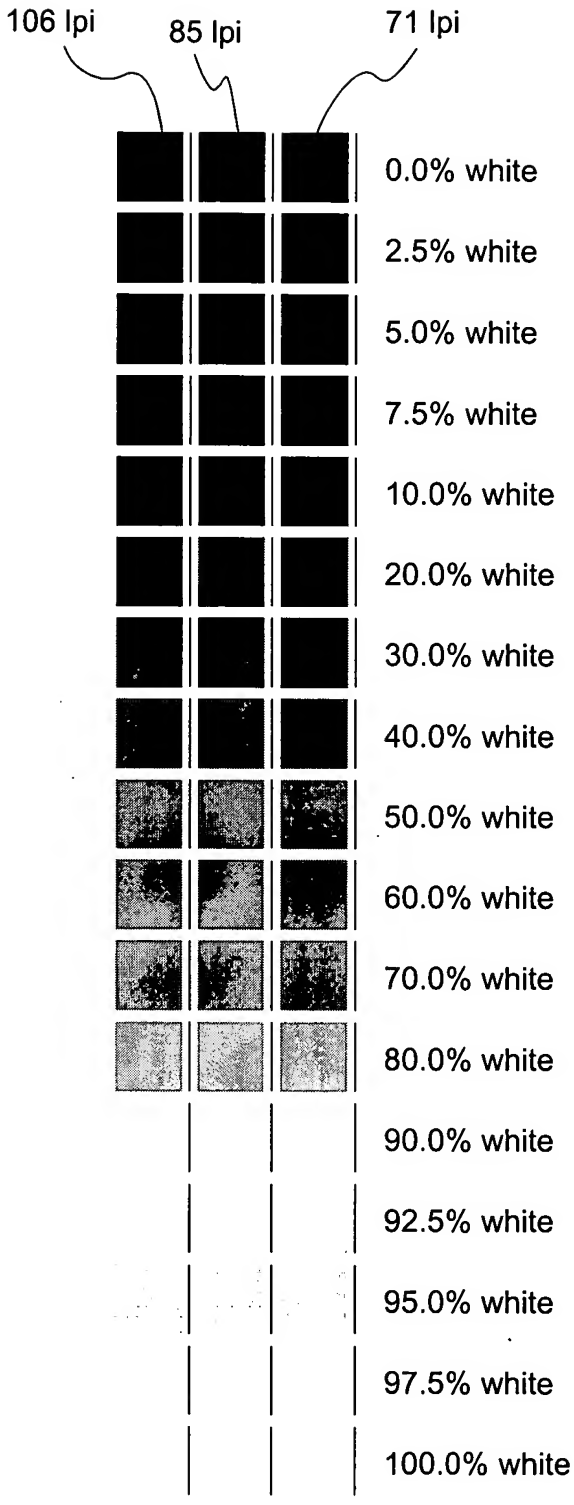

106 lpi
85 lpi
71 lpi
0.0% white
2.5% white
5.0% white
7.5% white
10.0% white
20.0% white
30.0% white
40.0% white
50.0% white
60.0% white
70.0% white
80.0% white
90.0% white
92.5% white
95.0% white
97.5% white
100.0% white
default round 106
round 85
round 71

FIG. 12

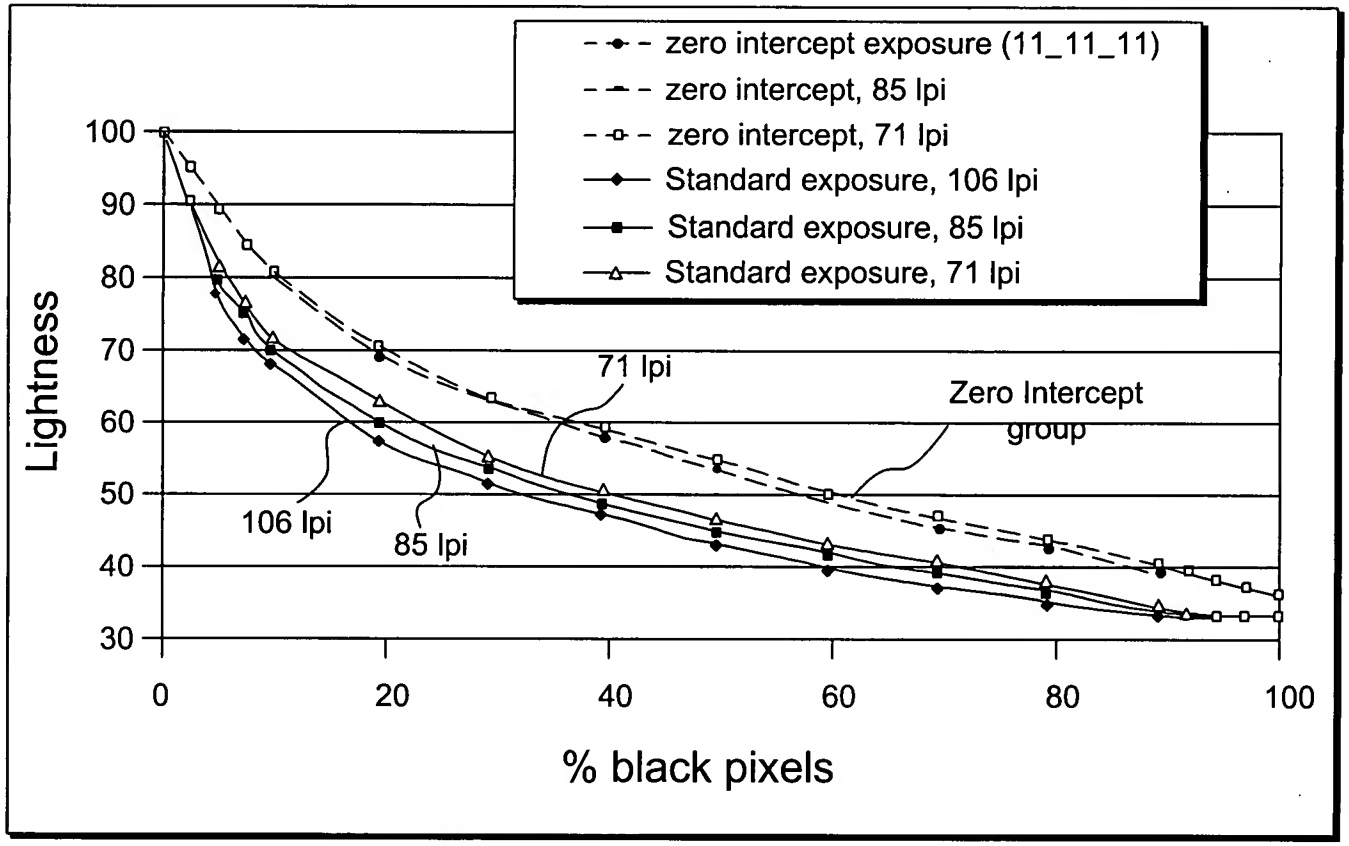

zero intercept exposure (11_11_11)
zero intercept, 85 lpi
zero intercept, 71 lpi
Standard exposure, 106 lpi
Standard exposure, 85 lpi
Standard exposure, 71 lpi
Lightness
100
90
80
70
60
50
40
30
0
20
40
60
80
100
% black pixels
71 lpi
Zero Intercept group
106 lpi
85 lpi

FIG. 13

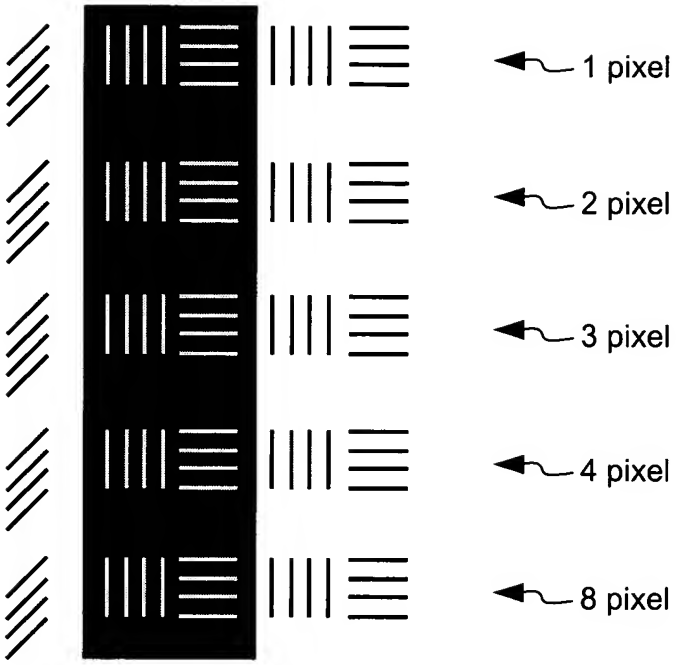


FIG. 14

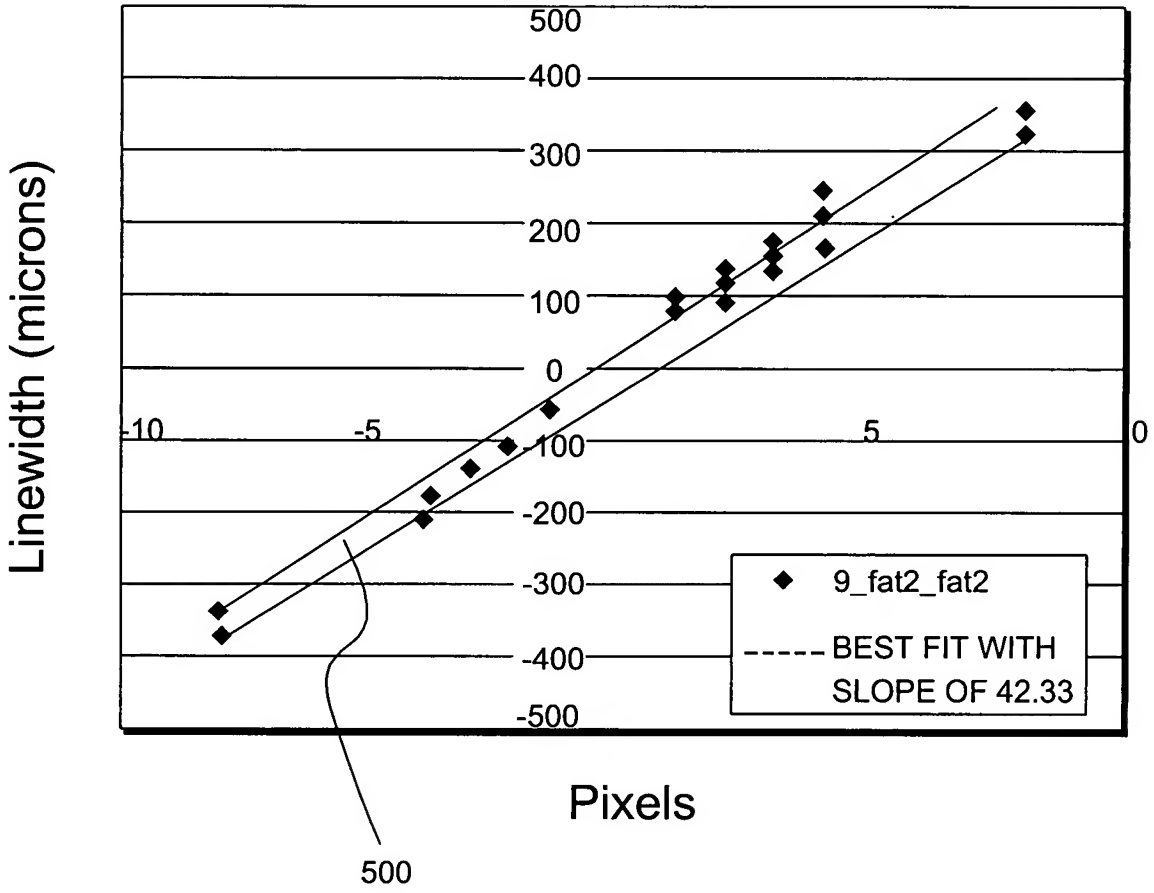

Linewidth (microns)
500
400
300
200
100
0
-100
-200
-300
-400
-500
-10
-5
5
0
9_fat2_fat2
BEST FIT WITH SLOPE OF 42.33
Pixels
500

FIG. 15

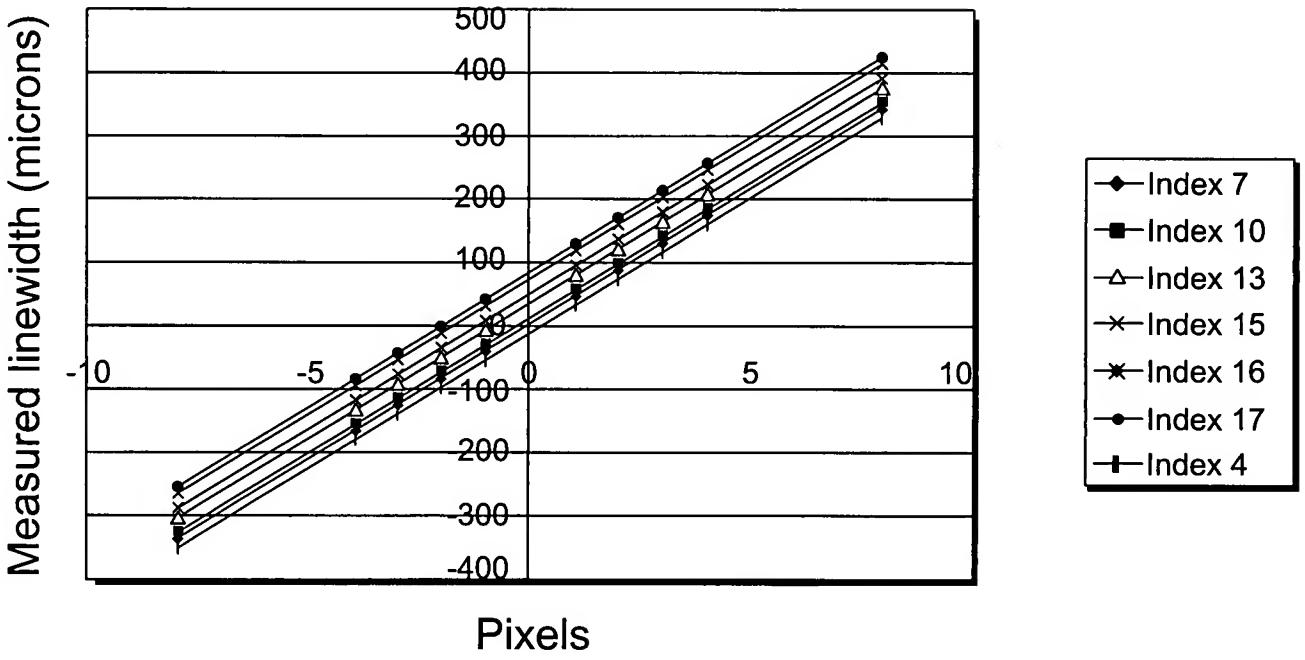

Measured linewidth (microns)
500
400
300
200
100
0
-100
-200
-300
-400
-10
-5
0
5
10
Pixels
Index 7
Index 10
Index 13
Index 15
Index 16
Index 17
Index 4

FIG. 16

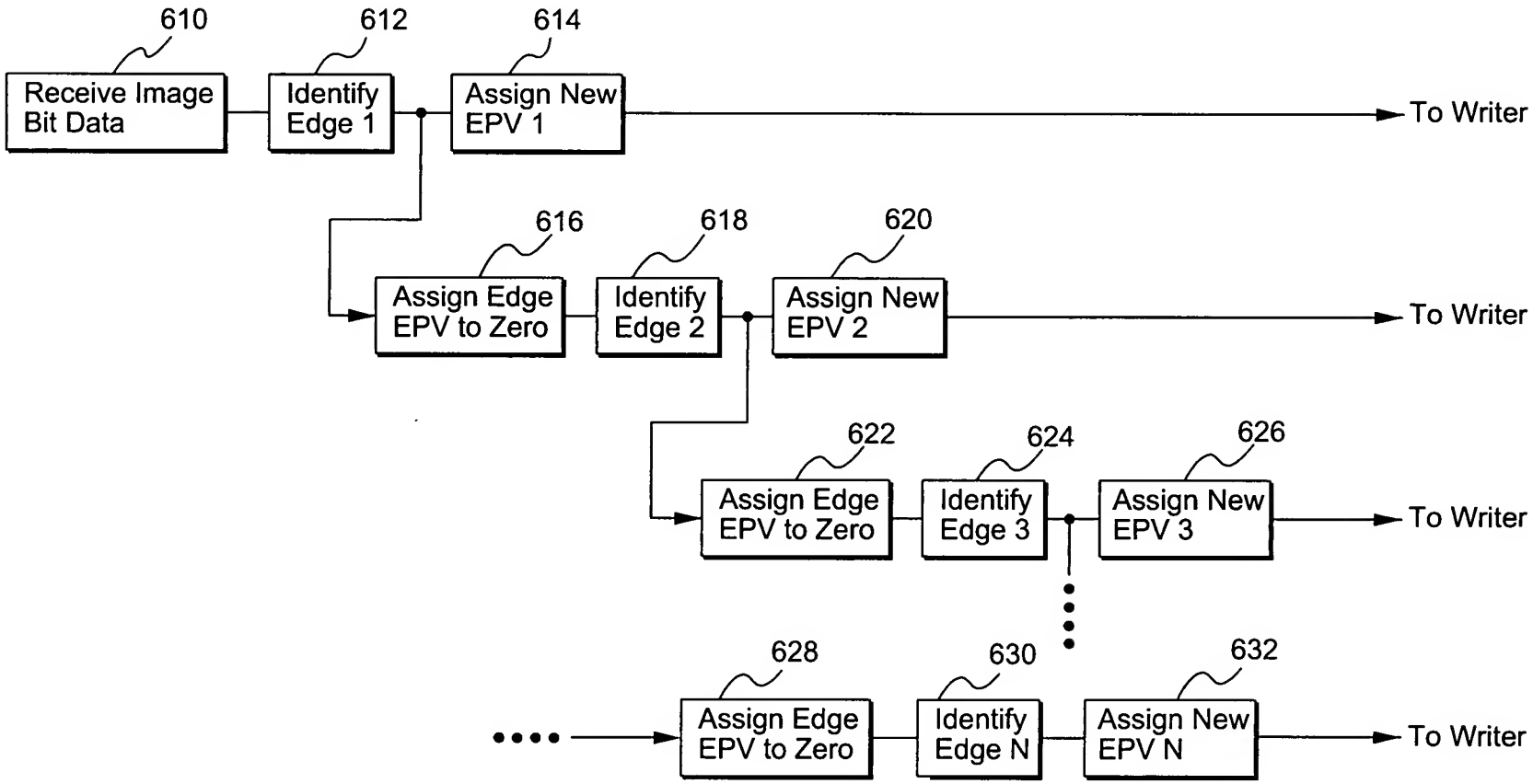

610
612
614
Receive Image Bit Data
Identify Edge 1
Assign New EPV 1
To Writer
616
618
620
Assign Edge EPV to Zero
Identify Edge 2
Assign New EPV 2
To Writer
622
624
626
Assign Edge EPV to Zero
Identify Edge 3
Assign New EPV 3
To Writer
628
630
632
Assign Edge EPV to Zero
Identify Edge N
Assign New EPV N
To Writer

FIG. 17

FIG. 18a

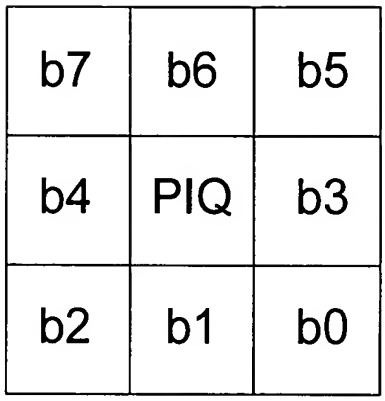


FIG. 18b

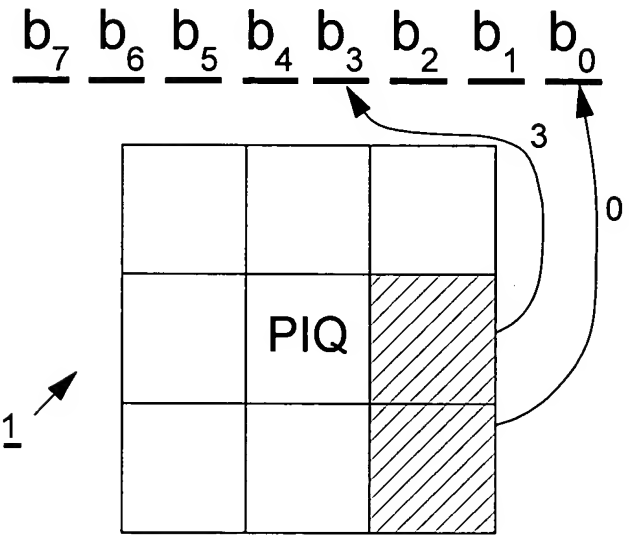


FIG. 18c

Fig. 18d

0	SE	S	S	SW	S	S	S	E	E	SE	SE	SE	SE	S	SE
W	SW	SW	S	W	SW	SW	SW	0	SE	S	S	SW	S	S	S
NE	E	SE	SE	0	SE	S	S	E	E	E	SE	E	E	SE	SE
NW	0	SW	S	W	SW	SW	S	NE	E	SE	SE	0	SE	S	S
N	NE	0	SE	NW	0	SW	S	NE	E	E	E	NE	E	SE	SE
NW	NW	W	SW	W	W	W	SW	N	NE	0	SE	NW	0	SW	S
N	NE	NE	E	N	NE	0	SE	NE	NE	E	E	NE	E	E	E
N	N	NW	0	NW	NW	W	SW	N	NE	NE	E	N	NE	0	SE
NW	0	SW	S	W	SW	SW	S	NE	E	SE	SE	0	SE	S	S
W	W	W	SW	W	W	SW	SW	NW	0	SW	S	W	SW	SW	S
N	NE	0	SE	NW	0	SW	S	NE	E	E	E	NE	E	SE	SE
NW	NW	W	SW	W	W	W	SW	N	NE	0	SE	NW	0	SW	S
N	N	NW	0	NW	NW	W	SW	N	NE	NE	E	N	NE	0	SE
NW	NW	W	W	NW	W	W	W	N	N	NW	0	NW	NW	W	SW
N	N	N	NE	N	N	NW	0	NE	NE	NE	E	N	NE	NE	E
NW	N	NW	NW	NW	NW	W	W	N	N	N	NE	N	N	NW	0